

found it necessary to withdraw from the excitement of active life. He settled down at Richmond, and once more gave himself up to Ovid, Virgil, and his old friends Paulus Manutius, Justus Lipsius, Ochinus, Fracastorius, &c. Increasing years brought increasing feebleness; and the severe weather of November last brought on an attack of bronchitis, of which he died suddenly on the 1st of December, in the seventy-eighth year of his age.—J. J. B.

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ON THE SYSTEMATIC ARRANGEMENT OF THE TAILLESS BATRACHIANS AND THE STRUCTURE OF RHINOPHRYNUS DORSALIS. BY DR. ALBERT GÜNTHER.

The organ which in the tailless Batrachians offers the most remarkable character, and which is most closely connected with their mode of life, is the *tongue*. Wagler has already separated from the other *Ranidæ* a group without tongue, *Aglossæ*, comprising all other *Ranidæ* under the name *Phaneroglossæ*, which have a tongue entirely adherent in front. This division was also afterwards accepted by Bibron, who changed the name of *Aglossæ* into that of *Phrynoglossæ*. The separation of the first group appears the more justifiable, as Müller came to the same result by another principle. I now add a third form, hitherto very imperfectly known, and the tongue of which is not yet described. *Rhinophrynus dorsalis* is the only Batrachian which has a tongue free in front, with the anterior tip capable of being stretched out of the mouth. The details are as follows:—The base of the cavity of the mouth is occupied by the tongue. The front part of this organ is rather narrow and cylindrical, with an obtuse rounded tip, of a similar shape to that of one of the small Rodentia; the front part is quite free; somewhat anterior to the middle of its length it is fixed to the base of the mouth by a frenulum; behind this it becomes gradually broader, and is fixed on each side by a muscular pad. The hinder edge is rounded, not notched, entirely adherent, and exhibiting only a transverse slightly prominent swelling. The tongue is entirely soft, with a velvet-like surface, covered with *papillæ filiformes*, which gradually become longer behind; and whereas the front tip of the tongue is again capable of being stretched out of the mouth, both halves of the *musculus genioglossus* are well developed, forming the very base of the cavity of the mouth.

I propose to divide the *Batrachia anura* into three groups:—

A. *Aglossa* : *B. a.* without tongue.

B. *Opisthoglossa* : *B. a.* with a tongue adherent in front, and more or less free behind.

C. *Proteroglossa* : *B. a.* with a tongue free in front and adherent behind.

We find by far the greatest development and the greatest variety of forms in the second group; and therefore I prefer to consider the principles of further division first in this group, hoping to obtain in this way points of view according to which we may characterize and divide the few known forms of the other groups. Those characters which are generally considered as the most important, and which always command a separation of two Batrachians, are :—

1. The presence or absence of the maxillary teeth.

2. The dilated or cylindrical form of the transverse process or diapophysis of the sacral vertebra.

3. The dilated or not dilated tips of the fingers and toes.

When we consider that the lower jaw of the tailed Batrachians is provided with a series of teeth, and that these are wanting in the same bone of all the tailless Batrachians, we are obliged to acknowledge the importance of this character,—the more so as this difference is followed by a difference in the mode of life, so far as I have been enabled to observe it in European forms. In the former the *teeth* are the organs for seizing the food; in the latter, as well in those with maxillary teeth as in the toothless, the *tongue* serves this purpose. The former seize the prey in the same way as the Saurians do, and hold and press it with the teeth; the latter seize it with the clammy tongue, either filliping it out of the mouth as the frogs, or only turning it out, as the toads do, with broad and fixed tongue: the mechanism of seizing is the same as in *Myrmecophaga*, *Picus*, or *Chamæleon*. On examining the recently swallowed animals from the stomach of a lizard or newt, we find them always in a more or less lacerated condition; whilst those taken from the stomach of a toothed or toothless frog or toad are constantly uninjured. This is even the case with *Ceratophrys* and *Cystignathus*, which are provided with the strongest dentition among all the Batrachians. The prey when seized is held and pressed by the tongue against the upper part of the cavity of the mouth; and though in some of the species there are maxillary teeth, they appear to be entirely without function, and palatine teeth alone give assistance to this second part of the action. Therefore, not being able to consider the character of the dentition among the tailless Batrachians as one intimately connected with their mode of life, I think it right to subordinate it to another character which does correspond with this pretension. In a similar way the value of dentition is disregarded in the Edentata, which contain the toothless *Myrmecophaga* and *Manis*, and on the other hand the *Dasybus gigas*, which exhibits more teeth than any other mammal except some Cetacea. So also the Salmonidæ contain the nearly toothless *Coregoni* and the strongly-armed *Salmones*, &c.

What influence the dilated or more cylindrical form of the process

of the sacral vertebra has upon the mode of life is difficult to explain, as it does not absolutely correspond with other physiological or anatomical characters. By the dilatation of these processes the pelvis obtains much more firmness; and a lateral motion is more or less entirely impeded. We should therefore expect to meet with this character in those Batrachians which are provided with the longest and most powerful hind legs, according to the physical problem, that the longest lever requires the strongest centre. But on the contrary, the Batrachians with the shortest legs exhibit a much-dilated sacral vertebra, whilst on the other hand the long-legged *Hylidæ* show the same peculiarity. In fact, *this osteological form seems to be connected with none of the modifications of locomotion*; for we find among these Batrachians good swimmers as well as bad, tree- as well as earth-frogs, those which always hop as well as those which often crawl; finally, we are unable to refer to it a peculiarity of any part of the propagation. Generally, I can only state—

1. *That all the Batrachia anura without maxillary teeth exhibit dilated processes of the sacral vertebrae, except the Hylaplesidæ*; but that, on the other hand, the *Batrachia anura* with maxillary teeth may have this bone sometimes dilated, and sometimes cylindrical in form.

2. *That all the Batrachia anura with paratoids exhibit dilated processes* (without any exception at present); but that, on the other hand, the *Batrachia anura* without paratoids have either this bone dilated or cylindrical in form.

From the above inquiries it is evident that I do not think this anatomical character fit for separating the whole group of the *Opisthoglossa*, so as to form two natural divisions; and there remains only the third of the above-mentioned characters,—*the dilated or not dilated tip of the fingers and toes*.

This natural character is connected with a strongly marked distinction in the mode of life, with *climbing trees*, which peculiarity is justly considered as one of the most important characters among the Vertebrata. No frog or toad without dilated toes is known to climb trees; and although our knowledge of the mode of life of the tropical forms is very limited, I have no doubt that the toothless Batrachians with dilated toes, of the tropics (*Hylaplesia*, *Hylædactylus*, *Brachymerus*, &c.), are enabled to climb trees, walls, &c., some being active during the day, others during the night. I am well aware that there are forms having the toes so slightly dilated that it is difficult to say to which section they belong; but in such instances the question will be decided either by observation of the living animals or by the more distinguishable form of closely allied species, as for example in the genus *Hylodes*. The objection to separating the toothless Batrachians in this way, they having been till now considered as a natural group, I get over by the fact that my two proposed series are parallel, and their members nearly corresponding; and I trust that at a not far distant time some of the wanting forms will be found. Therefore I divide the *Anura opisthoglossa* into two series:—

1. *Opisthoglossa oxydactyla* : *Opisthoglossa* with cylindrical or pointed tip of the fingers and toes.

2. *Opisthoglossa platydactyla* : *Opisthoglossa* with dilated tip of the fingers and toes.

Among the animals of both series we find that the same characters recur ; and so we are enabled to apply in both series the same further division. I have already mentioned what value I am disposed to attribute to the dentition ; and by co-ordinating with it the structure of the ear, I think we may obtain natural and scientifically-established groups. Especially I think we can thus satisfy the long-felt necessity of separating the *Bombinator*es in a strictly circumscribed group. Now-a-days a group, defined as Tschudi does the *Bombinator*es, “*Body and extremities short, head rounder than in the Ranæ, skin generally warty,*” is not fit to form a part of the natural system. Huschke was the first who directed the attention of naturalists to a peculiarity in the ear of *Bombinator igneus*, stating, in the ‘*Beiträge zur Naturgeschichte und Physiologie,*’ p. 39, “*Not much of a cavum tympani is to be seen in Bufo igneus, whereas muscles of the ossicula auditus appear to fill up the whole space.*” This information was not much enlarged by the inquiries of Geoffroy, Scarpa, and Windischmann ; but Johannes Müller, having found a similar structure in the ear of the *Pelobates* of France (*P. cultripes*), with his anatomical ingenuity applied this character for a distribution of the Tailless Batrachians into three groups :—

1. *Anura* with an entirely bony cavum tympani, with a cartilaginous cover of this cavity instead of a membranaceous tympanum, with the eustachian tubes united into a single aperture : *Dactylethra* and *Pipa*.

2. *Anura* with a partially membranaceous cavum tympani, with a membranaceous tympanum and the apertures of the Eustachian tubes separated : the greater part of the *Anura*.

3. *Anura* without tympanum, eustachian tubes, or cavum tympani, and with the cover of the fenestra ovalis cartilaginous : *Bombinator igneus* and *Pelobates cultripes*.

In rejecting this systematical arrangement of the *whole* suborder, I agree so far with Tschudi ; not, however, “*because the anatomist ought not to prescribe divisions to the zoologist,*” but rather because the Batrachians with imperfectly-developed ear would form together an unnatural group, and would be separated too far from other allied forms, if we tried to apply this character as that of a section. On the other hand, it is much more important than Tschudi supposes, because it proves to be of absolute value, as always indicating the *total absence of the tympanum*. Batrachians with well-developed ear exhibit sometimes a conspicuous, sometimes an indistinct, sometimes a hidden tympanum, which differences may offer in some cases a generic, in others only a specific character ; even in many instances the appearance of the tympanum is variable in the individuals of the same species, being more or less conspicuous. The tympanum is *hidden* in those Batrachians where it is formed by a transparent membrane ; but the skin of the body, not modified and not adherent, equally

covers the tympanic region, and the tympanum becomes visible only after the skin is removed. The tympanum is *indistinct* in those Batrachians where the skin of the body is firmly adherent to the tympanum, covering more or less of its surface. But in all these Batrachians the tympanum is *present*; and it is a great mistake to confound the characters of a hidden and of an absent tympanum; and much trouble and much misunderstanding would be saved to naturalists, if a more precise mode of expression were introduced into the descriptions. Secondly, we are obliged to acknowledge the value of the development of the ear in systematical arrangements, when we consider that this organ gradually returns to simplicity in the series of the Vertebrata, and that especially in the next class, of *Pisces*, it obtains systematic importance again. Therefore, though not accepting the structure of the ear as the first principle for the division of those animals, I shall combine it with the dentition. Tschudi discredited Müller's observation, vindicating for all Anura eustachian tubes and a cavum tympani, and only referring variations of the aperture of the eustachian tube in the cavum tympani to the age of the individual (*Bombinator igneus*). Besides he mentions frequent examinations of the structure of the ear, according to which this organ, especially among the "*Bombinatoridæ*," is liable to great variations, nearly in every genus, as regards the form and situation of the ossicula auditus, the chorda tympani, the tympanum, the tuba Eustachii, &c. It is a great pity that Tschudi never published these examinations; but in those which he has published I cannot quite agree with him.

The imperfect development of the ear I have found or recognized in *Bombinator igneus*, *Pelobates fuscus* and *cultripes*, *Alsodes monticola* (Wiegmann in *Telmatobius peruvianus*), *Micrhylla achatina**, *Phryniscus nigricans*, *lævis* and *cruciger*, *Brachycephalus ephippium*, *Hemisus guttatus* (*Engystoma guttatum*, Rapp), and finally in *Rhinophrynus dorsalis*, which, although not belonging to the *Opisthoglossa*, may be mentioned on account of the structure of the ear. In all these Batrachians, tympanum and cavum tympani are entirely absent; the eustachian tube is either entirely deficient, as I found it in *Phryniscus cruciger* and *Rhinophrynus* (and according to Müller's observations, perhaps in some specimens of *Bombinator igneus* and *Pelobates cultripes*), or it is only a blind tube without osteum tympanicum. Although I always found in some specimens of the same species the same development of the eustachian tubes, I do not venture to contradict other observations, according to which these tubes were found more or less accessible; and Tschudi may be right in stating a variation to occur with the age. But such a variation as regards abolition certainly would not reach the cavum tympani or the tympanum; and therefore I hold to the truth of the fact that in the aforesaid Batrachians this part of the ear is wanting. In *Bombinator* and *Pelobates* I have always found the osteum pharyngeum of the eustachian tube open. It is situated quite on the side of the pharynx,

* Cf. Tschudi's 'Batrachia,' p. 14.

is very small and narrow, and accessible only to a thin bristle; the tube passes near the united os sphenoidum and petrosium inwards and towards the back, crossing the carotis and the nervus vagus. The membrane by which it is formed becomes gradually excessively thin, and is closed without an aperture near the fenestra ovalis vestibuli. This aperture is really oval, closed by a cartilaginous cover and in direct contact with muscles; the nature of the vestibulum is proved by the soft white calcareous concrement. Such I found to be the structure of ear in *Hemisus guttatus* and *Micrhylla*. In *Phryniscus lævis* and *nigricans* and in *Brachycephalus* the osteum pharyngeum of the tube is more open. *Rhinophrynus dorsalis* exhibits the following details:—After removing the skin, an aperture of the ear is no more observable than a tympanum externally, the whole region being covered with muscles. The most accurate and repeated examination of old and young individuals did not enable me to find any osteum pharyngeum of the tube; at the point where it might be supposed to be situated, on the sides of the palatum molle, I found only a very short and flat groove, perhaps the same seen by Bibron, who describes the eustachian tubes as excessively small. After removing the muscles, the external entrance in the ear becomes conspicuous; it is the fenestra ovalis vestibuli—a large opening with a rounded outline, formed by swollen edges of the os petrosium. This opening is closed by a cartilaginous operculum, internally concave, externally convex, and so inserted by a membrane in the bony ring as to be rendered moveable. Round the bony ring arise some muscular fibres, which continue to the front edge of the shoulder-blade. Other muscular fibres, having arisen from the centre of the operculum, join them; and their function is, by moving the operculum outwards, to enlarge the cavity of the vestibulum. The vestibulum itself is spacious, quite bony, and forming an externally conspicuous, thin, flat *bullæ*. In the interior is enclosed in the saccum vestibuli—a large, rounded, white and soft calcareous concrement. Besides the fenestra ovalis are to be observed 3 or 4 minute openings, through which a bristle can reach immediately the cavity of the skull, and a larger one, oval, near the canales semicirculares.

Thus we find in these *Anura* slight modifications in the type of the structure of the ear, as it is found in the *Cæciliæ* and *Urodela* (*Amphiuma*, *Menopoma*, *Siredon*, *Proteus*, *Triton*, *Salamandra*),—a circumstance which directs us not to neglect it as a character for systematical arrangement; and therefore I divide the *Opisthoglossa oxydactyla* and *platydactyla* into the following sections:—

I. *Opisthoglossa oxydactyla*.

1. With maxillary teeth and perfectly-developed ear: *Ranina*.
2. With maxillary teeth and imperfectly-developed ear: *Bombinatorina*.
3. Without maxillary teeth, and with imperfectly-developed ear: *Brachycephalina*.
4. Without maxillary teeth, and with perfectly-developed ear: *Bufonina*.

II. *Opisthoglossa platydactyla*.

1. With maxillary teeth and perfectly-developed ear : *Hylina*.
2. With maxillary teeth and imperfectly-developed ear : *Micrhylina*.
- (3. Without maxillary teeth, and with imperfectly-developed ear : *not known*.)
4. Without maxillary teeth, and with perfectly-developed ear : *Hylaplesina*.

For the division of these sections into families I use :—

1. *The absence or presence of paratoids.*
2. *The form of the diapophysis of sacral vertebra.*
3. *The absence or presence of a web between the toes.*

I consider the latter character as the most subordinate of the three, and I have used for the systematical arrangement only those aggregates of *cryptæ*, which are found on the shoulder and generally are called paratoids. Similar glandular aggregates are found on other parts of the body ; and having had the opportunity of examining some new examples of such large glands, I think it useful to give an account of them in all the species.

In the genus *Pleurodema* a large gland is situated on the loins, in the males of *Pelobates* on the upper arm, in *Limnodynastes dorsalis** and *Bufo calamita* on the calves.

In other Batrachians the glands are situated on the shoulder, being either prominent and conspicuous, or hidden.

1. *Anura* with prominent paratoids are—*Alytes*, *Scaphiopus*, *Uperoleia*, *Bufo*, *Otilophus* and *Phyllomedusa*.

2. In other *Anura* the *cryptæ* are accumulated on the shoulder, but do not form a prominent gland, and the aggregate becomes visible only by an incision in the skin, the structure of the paratoid being the same : as in *Heleioporus*, *Pelodryas*, and *Rhinophrynus*. It is far more peculiar in *Kalophrynus*, which offers quite a smooth surface of the skin ; and not only on the shoulders, but on the whole surface of the back, the skin is densely crowded with large *cryptæ*, together forming a large dorsal paratoid.

Having now gone through the most important characters upon which I base the division of the *Opisthoglossa*, I add the following tabular arrangement, which will show at once the families thus created, their natural relationship, and the parallelism of more remote families and characters of forms which may be discovered. The vertical divisions show their agreement in the anatomical, the horizontal ones in the zoological characters.

* In this species I have only had the opportunity of examining the males.

Both the series of *Opisthoglossa* are not to be considered as forming one continued series between the *Aglossa* and *Proteroglossa*; they do not form one series of animals, descending from the most highly organized form to the lowest one: such a gradation is equally found in both series; and one is at once struck with the identity of the characters in the single families, if brought side by side in two parallel series.

OPISTHOGLOSSA.

	OXYDACTYLA.	PLATYDACTYLA.	
Ranina.	{ Ranidæ. Cystignathidæ. Discoglossidæ. Asterophrydidæ. Uperoliidæ. Alytidæ.	{ Polypedatidæ. Hylodidæ. Hylidæ. Phyllomedusidæ. Pelodyadidæ.	} Hylina.
Bombinatorina.	{ Bombinatoridæ.	{ Micrhylidæ.	
Brachycephalina.	{ Phryniscidæ. Brachycephalidæ. Rhinodermatidæ.	{ Hylædactylidæ. Brachymeridæ.	} Hylaplesina.
Bufoina.	{ Engystomatidæ. Bufonidæ.	{ Hylaplesidæ.	

I am always afraid of admitting teleological principles into natural science; the most important results of truth are gained by adhering to objective facts, and by inquiring into them. Each system should be adapted only to the present state of our knowledge of animals; but at last we must come to that point where analogies will enable us to look further; and the future will show (if it is allowed to presume so far) that, among the forms which hereafter may be discovered, there will be found correspondents to the *Asterophrydidæ*, *Phryniscidæ*, *Brachycephalidæ*, *Bufoinidæ*, and *Hylaplesidæ*, viz. :—

1. *Hylina*, without paratoids, with dilated sacral vertebra and free toes.
2. *O. platydactyla*, without maxillary teeth and with imperfectly developed ear.
3. *Hylaplesina*, with paratoids, with dilated sacral vertebra, and webbed toes.
4. *Bufoina*, without paratoids, with not dilated sacral vertebra and free toes.

Only three genera are known belonging to the first group of *Anura*, to the *Aglossa*,—*Dactylethra*, *Pipa* and *Myobatrachus*, the latter of which is imperfectly known to myself from a short notice of Dr. Gray in the ‘Proc. Zool. Soc.’ All these three genera offer such characters as to become the types of as many families. But as I do not know whether the star-like configuration of the toes in *Pipa*, or the horny claws of the toes of *Dactylethra*, have the same functional importance as in the *Oxydactyla* and *Platydactyla*, or whether the two horizontal fangs in the intermaxillary bone of *Myobatrachus* are true teeth, or only apophyses (as in the lower jaw of *Tomopterna*), I am at a loss which of these characters must be subordinated to the

other; and therefore I refer first to the more-known structure of ear, and propose for the present the following division of this group :—

- I. *Aglossa* with united eustachian tubes and entirely bony cavum tympani.
 - a. With maxillary teeth : *Dactylethridæ*.
 - b. Without maxillary teeth : *Pipidæ*.
- II. *Aglossa* with separated eustachian tubes; cavum tympani?
 - a. With two horizontal fangs in the intermaxillary bone : *Myobatrachidæ*.

Finally, of the last group of PROTEROGLOSSA only one genus is known, forming the type of a family—*Rhinophrynidæ*, the complete characters of which would be—

Proteroglossa without maxillary teeth, with imperfectly developed ear, paratoids, dilated diapophysis of sacral vertebra, and webbed toes.

Bibron has given the only published description of *Rhinophrynus dorsalis*; but having had only a single specimen in an imperfect condition, he was not enabled to point out all its peculiarities. I therefore finish this paper with a full description of it.

The body being of an oval depressed shape, appears to be broader than it in reality is, because the skin is too wide for the circumference of the body, forming on each side a broad longitudinal fold. It is rounded on all sides, the belly being rather more flat; the whole surface smooth, only in some places finely granulated. The head is confounded with the body, situated on the same level, and appears to be only the tapering front part of it; being somewhat depressed, it tapers conically, and ends suddenly with the obtuse, truncated top of the muzzle. The front part of the muzzle forms, if closed, a flat round disk, somewhat similar to the snout of a pig, but differing by being separated by the cleft of the mouth into an *upper smaller* and a *lower larger* half. The mouth itself is so peculiarly formed as to be unlike that of every other Batrachian. The cleft is situated in one plane, not on the lower side of the muzzle, but above the middle; and if the snout be imagined to be a truncated cone, the cleft splits it by a vertical cut going from the truncated plane to the base; the cleft therefore does not form a convex line, but three sides of the vertical cut of a truncated cone. Being of itself not small, and reaching nearly to the anterior angle of the eye, it does not allow a considerable widening of the mouth, as is necessary where a sling-tongue is present; and when we consider this configuration connected with the plump figure of the animal, we may conclude that its food consists only of small and slow animals. The nares are situated on the upper side of the head, at some distance from the end of the snout; they are formed by a small oval opening, surrounded by a low cutaneous fold, and can probably be closed. The eyes are situated but little further behind the nares, but rather more outwards; they are small, and placed behind a narrow cleft formed by the swollen external eyelids.

The posterior parts of the animal are very large and muscular. Just in the centre is the anus, situated in the upper end of a deep longitudinal furrow, which, formed by two thick cutaneous folds, extends along the lower part of the belly; probably it serves for conducting the products of generation. Each of the folds is in connexion with a broad muscle, destined for removing them one from the other; along the middle of the bottom of this furrow is a raphe, as in the perinæum of man. The extremities are short; and the single members are not conspicuous, on account of the wide and enveloping skin; the anterior ones are enveloped to the middle of the forearm. The fingers are four, quite free, ending in a blunt tip without being dilated; the thumb is the shortest, the second and fourth are nearly of equal length, the third much longer. There are callosities on the inner and outer side of the carpus. The hinder legs become more conspicuous from the articulation of the knee; the lower leg and tarsus are short; but notwithstanding the bluntness of the extremities, a free motion is allowed by the wide-folded skin. The planta is very broad; and the toes are joined by a web, which, deeply notched between the toes, reaches the extreme phalange as a narrow fold. The os cuneiforme forms a high, elongated, elliptical prominence, not so hard and sharp as in *Pelobates*, the integument of which may be separated from the bone together with the skin, and exhibits a surface with transverse grooves, a circumstance which affords a firmer hold when in locomotion. Immediately before this prominence is situated the rudiment of the first toe, modified into a perfectly similar and also striated but smaller prominence. This must support locomotion, especially as its surface is sometimes injured and lacerated. The four other toes end with a small round knot, the second being the shortest, the fourth the longest, the third intermediate between the second and fourth, the fifth rather longer than the second.

On the back, on the head, and round the snout, the skin is firmly adherent, all other parts being enveloped by it as by a too wide sac. It appears to be smooth on the back, but is pierced on all parts with innumerable minute pores. On the head appear scattered very small warts, becoming gradually more crowded towards the end of the snout; they are not glandular in structure, perhaps bearing organs of feeling. The disk-like end of the snout is entirely smooth, polished and soft, but of a firm structure. There are whitish prominences on the neck, the belly, and on the under sides of the legs; they obtain, especially on the latter place, the circumference of fig-seed, and are glands without ductus excretorii. There is externally nothing of a parotis to be seen; but by an incision is found a thick aggregate of glands, as above mentioned, situated above and behind the shoulder-blade, and of the same circumference as the skull: the ductus excretorii of the single glands are not different from those scattered on the other parts. In the subcutaneous tissue a black pigment is thickly deposited: the colour of the upper part is dark bluish-olive, either uniform or with yellowish spots along the vertebral line, sometimes confluent into a streak; spots of the same

colour are sometimes seen on the shoulder, and especially on the sides and on the upper parts of the extremities. The snout and the under parts are paler, and the disk of the snout is colourless.

The eye is protected by two external swollen eyelids, but the lower eyelid forms a double fold, the external of which is merely a fold of the cutis, the internal being transparent and representing an internal eyelid. There is no *membrana nictitans*; the pupil is round; the *lens* round, somewhat compressed; no *pecten*. The small size of the eye evidently shows that the animal is nocturnal.

There are no teeth; the edge of the jaws is obtuse and truncated, especially that of the lower jaw. Upon examination of the cavity of the mouth, it is found as spacious as the natural entrance is narrow. Behind the articulation of the mandibula, and on the side of the hinder insertion of the tongue, opens a large cavity, covered inside with a strongly-folded *mucosa*, and outside with a stratum of muscular fibres; the end of the bottom of this extends behind the head, and is situated near the insertion of the *musculus suprascapularis* at the shoulder-blade. Supposing this cavity to be a vocal sac, I do not think that it will be found in females; and it is a peculiarity of this animal that the vocal sac is covered by a muscular stratum, thus being quite separated from the skin; nor am I acquainted with any other instance in which the vocal sac reaches so far backward. The entire upper part of the cavity of the mouth is very concave, and covered by such a thin *mucosa* as to render the whole configuration of the bone transparent. Near the middle of the palate, and somewhat laterally, the inner nostrils are situated, being roundish-oval and of moderate size. The anterior part of the pharynx is separated from the hinder part by a cartilaginous transverse pad; and the latter part deserves the name of a *palatum molle*, inasmuch as it is provided with a soft body covered with a *mucosa*, as a similar one is found at the same place in the *Cyprinidæ*. Between the tongue and *cartilago thyreoidea* is situated a spacious cavity, such as is generally found in *Anura* beneath the tongue; it is quite closed. I think it is a *bursa mucosa*.

Concerning the *situation* of the intestines, the following is to be noticed. The heart is situated somewhat towards the right side of the medial line; and it is a highly interesting fact that it is surrounded by the liver in a similar way as in higher animals, as in other *Batrachians* it is surrounded by the lungs. The stomach is quite on the right side, and partly covered by the left hepatic flap, separated from the heart only by a part of the peritoneum: it is on its left side. The right lung is behind the liver; the left lung is larger and is placed behind the liver and stomach. The situation of the other intestines is the same as is generally found in the *Anura*.

The *glottis* is a simple cleft; the *larynx* and *trachea* are conspicuously separated by a pair of excessively large, thick, and soft *ligamenta vocalia*. The larynx itself is very spacious, and forms nearly the cavity of a globe; the trachea is of a similar form, separated from the lungs only by a slightly produced fold of the *mucosa*. The *lungs* and the *vascular system* do not differ from those organs in

the other *Anura*, except in the situation, as mentioned above. There is a single ventriculus and two separated atria; from the former rises a very short bulbus arteriosus, the interior of which and of the other vessels could not be examined on account of their condition. The bulbus is soon divided into two strong stems, each of which emits three branches, ascending together for a short distance,—namely, an arteria pulmonalis, a carotis descendens, and a united stem of the a. cerebralis and a. lingualis. The right atrium receives the blood of the veins of the body; the left one that of two venæ pulmonales.

We find more peculiarities in the *tractus intestinalis*. The œsophagus is very strong, its circumference equal to that of the stomach; the mucosa is provided with very long villi, projecting nearly 1 mill. into the cavity; the next outer stratum is thick and of tendinous texture, thickest in the anterior and posterior medial line, and forming two very strong tendinous bands. These serve for the insertion of transverse muscular fibres, going from the anterior medial line to the posterior one, and forming two very strong constrictores, each surrounding one half of the œsophagus. If they co-operate, they then constrict the œsophagus as circular fibres would do; but by the separation into two parts the effect is rendered more powerful. The entrance from the œsophagus into the stomach is marked externally by the absence of the muscles, internally by the beginning of the mucosa ventriculi, which is deeply and longitudinally folded and wants the long villi. The stomach is short, ovoid, and gradually lost in the smaller intestines without a pylorus; the latter are $3\frac{3}{4}$ times the length of the body, and suddenly open into the excessively wide rectum. The *pancreas* is large, and joined with the intestine by a wide ductus Wirsungianus; about half an inch below the stomach three or four smaller branches open into the intestine, separated from the chief ductus; probably this is the place for the mouth of the ductus choledochus, which I could not find. The *liver* is large, and at the first glance it appears to be separated into a right half and a larger left one; but both parts are joined by a very narrow bridge, passing behind the heart: the left flap has a deep incision. Both flaps surround the heart, and the left one also the stomach. The gall-bladder is situated just in the medial line, beneath the uniting bridge, not in direct contact with the hepatic parenchyma, but fixed to it by the peritoneum; from each flap of the liver, one ductus hepaticus opens separately into the bladder. The *organa uropoietica* do not offer any remarkable differences, at least not in the male. The testicles oval; kidneys elongate, cylindrical; corpora adiposa formed by long appendages; the bladder enters the cloaca on the anterior part, the urethræ on the posterior one.

The *osteological* peculiarities only consist in differences of form; and as far as they can be made out in a single coherent skeleton, they are the following. All the external bones of the skull are entirely ossified; the cranium is flat, depressed, very broad, without crest, and with a sharp not prominent lateral edge. The foramen jugulare is very large, but closed by a fibrous membrane pierced by

the nervus vagus and glossopharyngeus. The os petrosum is distinguished by a spheroid flat bulla ossea, which is quite different from that in some Mammals, being there the ossified cavum tympani, here a part of the vestibulum; it is very thin and transparent, so that the calcareous concrement may be seen. The upper part of the cranium is as broad as the os basilare is expanded; from the broad united ossa parietalia and frontalia suddenly projects a narrow long bone, situated between the nostrils, parallel with the ascending processes of the intermaxillary bone, and nearly reaching the symphysis of the intermaxillary bones. This is formed by the frontalia anteriora; and there is in front a vestige of a suture, perhaps of formerly-separated nasal bones. The edge of the maxillary and intermaxillary bones is sharp; and the latter are provided with very long and narrow ascending processes. There are nine vertebræ, the second with hammer-like, the third and fourth with long cylindrical diapophyses; that of the sacral vertebra is moderately dilated, triangular, and flat, and joined with the ossa ilea by a much-developed cartilaginous symphysis. The scapula is not notched on the inner edge; the bones of the extremities are distinguished by their shortness and by the large size of their condyles. There is no processus xiphoideus.

The contents of the stomach consisted of a great many excessively small beetles, some lumps of earth, and small pieces of stick. I suppose that the animal catches those insects by stretching out the tongue, as some other animals do. In this action small particles of earth, &c. adhere to the tongue. The lumps of earth found were balled together only in the stomach, being too large to have passed the narrow cleft of the mouth*.

A FEW REMARKS ON THE HABITS AND ECONOMY OF THE
BROWN-CAPPED POMATORHINUS (P. RUFICEPS, HARTLAUB).
BY G. KREFFT.

The range of this bird does not appear to be a very extensive one; it was first discovered in the Polygonium Flats bordering the Murray River and its backwaters; but on the Darling they were not found so plentiful. Their favourite haunts are clusters of dead box timbers, and scrubby flats studded with salt bush, &c.

This bird is remarkably shy, and so cunning, that in almost all cases it will evade pursuit by running into some scrubby bush, and hide there till the danger is over. Its power of flight is exceedingly moderate, and closely resembles that of the brown Tree-creeper.

These birds are always found in flocks of from four or five to twenty and more. They keep a good look-out; and as soon as they suspect danger, they will rise with a sharp whirring noise, and seek shelter

* M. Sallé, to whom science is indebted for the discovery of this strange animal, writes in a letter, "Je sais bien peu de choses sur le *Rhinophrynus dorsalis*; il vient des terres chaudes et tempérées de l'Etat de Vera Cruz; on le trouve dans la terre et assez profondément enfoncé, quelquefois à un pied ou deux; il paraît y vivre, il a des mouvements très lents et il est très mou, ce qui fait, que les indigènes le désignent dans des endroits sous le nom de *Sapo sin hueros* (Crapaud sans os); je ne sais pas comment il peut s'enterrer ni de quoi il se nourrit."